UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/836,674	04/16/2001	Sven Lindfors	SEPP11.001AUS	9836

20995 7590 07/25/2002

KNOBBE MARTENS OLSON & BEAR LLP
620 NEWPORT CENTER DRIVE
SIXTEENTH FLOOR
NEWPORT BEACH, CA 92660

EXAMINER	
SONG, MATTHEW J	
ART UNIT	PAPER NUMBER
1765	

DATE MAILED: 07/25/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

MF

Office Action Summary	Application No. 09/836,674	Applicant(s) LINDFORS, SVEN
	Examiner Matthew J Song	Art Unit 1765

-- The MAILING DATE of this communication appears on the cover she t with the correspondenc address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____ .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-34* is/are pending in the application.

4a) Of the above claim(s) *27-34* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-26* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *16 April 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *4,5* .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

DETAILED ACTION

Election/Restrictions

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:

I. Claims 1-16, are drawn to a method, classified in class 117, subclass 84.

II. Claims 27-34, are drawn to an apparatus, classified in class 118, subclass 715.

2. Inventions I and II are related as process and apparatus for its practice. The inventions are distinct if it can be shown that either: (1) the process as claimed can be practiced by another materially different apparatus or by hand, or (2) the apparatus as claimed can be used to practice another and materially different process. (MPEP § 806.05(e)). In this case the apparatus could be used for heat treatment.

3. Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

4. During a telephone conversation with Ravi Narula on 6/19/2002 a provisional election was made with traverse to prosecute the invention of I, claims 1-26. Affirmation of this election must be made by applicant in replying to this Office action. Claims 27-34 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

Information Disclosure Statement

5. The information disclosure statement filed as paper 4 fails to comply with the provisions of 37 CFR 1.97, 1.98 and MPEP § 609 because item 5 lacks a publication date. It has been placed in the application file, but the information referred to therein has not been considered as to the merits. Applicant is advised that the date of any re-submission of any item of information contained in this information disclosure statement or the submission of any missing element(s) will be the date of submission for purposes of determining compliance with the requirements based on the time of filing the statement, including all certification requirements for statements under 37 CFR 1.97(e). See MPEP § 609 ¶ C(1).

6. The information disclosure statement filed as paper 6 lacks a PTO-1449. The attached patent related to paper 6 is identical to the patent submitted with the information disclosure statement of paper 5. The reference is acknowledged by the examiner in the PTO-1449 of paper 5.

Claim Rejections - 35 USC § 102

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in-
> (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effect under this subsection of a national application published under section 122(b) only if the international application designating the United States was published under Article 21(2)(a) of such treaty in the English language; or
> (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that a patent shall not be deemed filed in the United States for the purposes of this subsection based on the filing of an international application filed under the treaty defined in section 351(a).

8. Claims 1-20 and 22-25 are rejected under 35 U.S.C. 102(e) as being anticipated by Sneh et al (US 6,305,314).

Sneh et al discloses a method of avoiding contamination of films deposited by atomic layer deposition (ALD), wherein chemical vapor deposition (CVD) deposited contamination of ALD is prevented by use of a pre-reaction chamber that effectively causes otherwise contaminating gaseous constituents to deposit on the wall of a gas-delivery apparatus prior to entering the ALD chamber (Abstract). Sneh et al discloses a precursor "A" **49**, i.e. first reactant, and precursor "B" **50**, i.e. second reactant, and a precursor partial pressure vs. time using rapid pulsing of the chemical precursor species, inert gas purge steps and a pre-reactor, where the pre-reactor is used to remove a "tail", i.e. residual reactant, at the end of each pulse (Fig 4, Fig 5, col 10, ln 5-45 and col 2, ln 5-15). Sneh et al also discloses a deposition chamber **59**, a substrate **61** to be coated, a gas distribution device **60**, a gas sourcing and pulsing apparatus **57** for supplying gases and a pre-reactor **66** for improved control of CVD side reactions (col 10, ln 60-67 and col 11, ln 1-8). Sneh et al also discloses the pre-reaction process may take place on any surface with sufficient activation energy (col 11, ln 20-27) and a pre-reactor incorporated into the gas distribution device **60**, where the undesired CVD side reactions are caused to occur on a free-standing thermally heated surface inside the gas distribution surface and the necessary thermal input is provided by proximity of the showerhead apparatus to the substrate **61** (col 11, ln 28-46). Sneh et al also discloses a pre-reactor incorporated into the gas distriution showerhead, where the undesired CVD side reactions are caused to occur on the heated surface of the gas distribution showerhead, i.e. the wall of the pre-reactor (col 11, ln 45-60 and Fig 8). Sneh et al also discloses undesired CVD reactions nucleate in the gas phase leading to undesirable particle, i.e. solid

reaction product, accumulation in the deposition chamber (col 10, ln 25-35). Sneh et al also discloses for ALD, molecular precursors are introduced into the ALD reactor separately by flowing one precursor at a time followed by an inert gas purging and where a metal precursor reacts with a substrate and a second precursor is used to restore the reactivity of the substrate (col 1, ln 65-67 and col 2, ln 1-56). Sneh et al discloses at least one passage for delivery of a precursor material from between a source and a processing chamber (claim 1). Sneh et al also discloses substrates are introduced and removed from the chamber **59** via a valve **64** 9col 10, ln 60-67).

Referring to claim 1, Sneh et al discloses a precursor "A", i.e. first vapor and a precursor "B", i.e. second vapor, where a first vapor in the form of a pulse is feed into a reaction chamber and forms a thin film on the substrate and a "tail" portion, this reads on applicant's residual vapor and undesirable side CVD reaction with the two precursor nucleate in the gas phase leading to undesirable particle accumulation, where particle reads on applicant's solid reaction product.

Referring to claim 2, Sneh et al discloses the residual first reactant a gaseous "tail", this reads on applicant's residual reactant is in the gas phase.

Referring to claim 3, Sneh et al discloses undesired CVD side reactions are caused to occur on the heated surface of the gas distribution showerhead, this reads on applicant's residual first reactant is adsorbed on the walls of the reaction chamber.

Referring to claim 4, Sneh et al discloses a pre-reactor **66** upstream from a deposition chamber **59**, this reads on applicant's second chamber in Fig 6.

Referring to claim 5, Sneh et al discloses ALD deposition occurs in the deposition chamber.

Referring to claim 6, Sneh et al discloses an ALD film forms in the second reaction chamber.

Referring to claim 7, Sneh et al discloses CVD side reaction occur with residual first reactant in the pre-reaction chamber.

Referring to claim 8, Sneh et al discloses CVD side reactions occur on the heated surface of the gas distribution showerhead, i.e. pre-reactor, where a CVD side reaction reads on applicant's reaction product.

Referring to claim 9, Sneh et al disclose alternately feeding a first vapor and a second vapor in Fig 5.

Referring to claim 10, Sneh et al discloses a first reactant reacts with a second reactant in a CVD side reaction to form undesirable particles.

Referring to claim 11, Sneh et al discloses reactants "A" and "B".

Referring to claim 12, Sneh et al discloses CVD side reactions with the first reactant and second reactant occur in the pre-reactor.

Referring to claim 13, Sneh et al discloses the pre-reactor is immediately adjacent and is adapted to freely communicate with the second reaction chamber, where pre-reactor is incorporated in the gas distribution showerhead adjacent to the second reaction chamber.

Referring to claim 14, Sneh et al discloses at least one passageway for delivering precursor materials, this reads on applicants first channel for feeding the first reactant and a second channel for delivering a second reactant.

Referring to claim 15, Sneh et al discloses the feed channels are connected to the pre-reactor.

Referring to claim 16, Sneh et al discloses CVD side reactions between the first and second reactant occur in the pre-reactor.

Referring to claim 17, Sneh et al discloses residual first reactant is reacted with the second reactant to form a solid product, where the first reactant is depleted, thereby preventing the residual first reactant from entering the second chamber (Fig 5).

Referring to claim 18, Sneh et al discloses the necessary thermal input for the pre-reaction chamber is provided by heat transfer from the substrate, this reads on applicant's pre-reactor is operated at the same temperature as the second reactor.

Referring to claim 19, Sneh et al discloses the substrate, where the thin film is deposited is removed from the chamber via valve **64**, this reads on applicant's reaction product is removed from the reaction chamber separately from the thin film. It is inherent to Sneh et al that the reaction product is removed separately from the thin film because the reaction product is formed on the walls of the pre-reactor and the reactor separately attached to the reactor

Referring to claim 20, Sneh et al discloses the CVD side reactions are caused to occur on a free-standing, thermally heated surface inside the gas distribution system, where the free standing, thermally heat surface reads on applicant's discardable substrate.

Referring to claim 22, Sneh et al is silent to a concentration of the residual first vapor in the pre-reactor is reduced to less than 1 ppm by reacting the residual first vapor with the second vapor. It is inherent to Sneh et al to reduce the concentration of the first residual vapr to less than

1 ppm because Sneh teaches the same method of reacting the first reactant with the second reactant in a pre-reactor, as applicant.

Referring to claim 23, Sneh et al is silent to a concentration of the residual first vapor in the pre-reactor is reduced to less than 1 vol-% by reacting the residual first vapor with the second vapor. It is inherent to Sneh et al to reduce the concentration of the first residual vapr to less than 1 vol-% because Sneh teaches the same method of reacting the first reactant with the second reactant in a pre-reactor, as applicant.

Referring to claim 24-25, Sneh et al discloses an inert gas purge (evacutation).

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

10. Claims 14-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sneh et al (US 6,305,314) in view of Suntola et al (US 6,015,590).

Sneh et al discloses all of the limitations of claim 14, as discussed previously in claim 4, except the first vapor phase reactant is fed into the reactor through a first feed channel and the second reactant is fed into a reaction chamber through a second channel.

In a method of growing a thin by atomic layer epitaxy (ALE), Suntola et al teaches an apparatus, which thin films are grown using the ALE process (col 8, ln 30-50) and an inflow channel **28** for a starting material B and a second inflow channel **29** for a starting material A (Fig

2 and col 10, ln 10-20). Suntola et al also teaches the reaction space is purged between two successive vapor phase pulses such that less than 1% of the residual components from the first vapor phase remains prior to the inflow of the second vapor phase (Abstract) It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Sneh et al with Suntola et al because the separate inflow channels isolates the starting materials from each other preventing pre-mature reactions (col 7, ln 50-65).

Referring to claim 15, the combination of Sneh et al and Suntola et al teaches the reactant gas connect to the pre-reactor.

Referring to claim 23, the combination of Sneh et al and Suntola et al teaches the residual components of first vapor pulse are less than 1% prior to the second pulse.

11. Claims 19 and 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sneh et al (US 6,305,314) in view of Soininen et al (US 5,855,680).

Sneh et al discloses all of the limitations of claim 21, as discussed above in claim 4, except the reaction product is removed from the pre-reactor by cleaning the wall.

In an apparatus for growing thin films, Soininen et al teaches in an atomic layer epitaxy (ALE) method points where undesired film growth occurs must be subjected at regular intervals to surface cleaning from grown films or the contaminated parts must be replaced by new ones (col 8, ln 35-50). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Sneh et al with Soininen et al because cleaning reduces part replacement.

Referring to claim 19, Sneh et al discloses removing the thin film via a valve, but is silent to the removal of the reaction product. It is inherent to Sneh that the reaction product is removed

separately from the thin film because the reaction product is formed on the walls of the pre-reactor and the reactor separately attached to the reactor but if it is not inherent then the combination of Sneh et al and Soininen et al teaches the reaction product is removed via cleaning and the thin film is removed via a valve.

12. Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sneh et al (US 6,305,314) in view of Suntola et al (US 4,413,022).

Sneh et al discloses all of limitations of claim 26, as discussed previously in claim 1, except the pressure in the reaction chamber is in the range of 1 to 100 mbar.

In a method of growing thin films, Suntola et al teaches an ALE method, where an Al_2O_3 thin is formed in a reaction chamber operating at 2 mbar (example 1 and example 5). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Sneh et al with Suntola et al because the reactor pressure results in an Al_2O_3 thin film useful in the semiconductor industry.

Conclusion

13. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Kitahara et al (US 5,300,186) teaches an atomic layer epitaxy (ALE) for the deposit of a group III-V semiconduct at a pressure of 20 Torr, which is approximately 26 mbar. (col 4, ln 15-67).

Wallace et al (US 5,316,793) teaches an ALD method, where undesirable gas phase reactions are avoided in a reservoir by admitting precursors sequentially (col 4, ln 35-67).

Mastsumoto (US 4,840,921) teaches a growing chamber **11** and a growing chamber **13** (Fig 1).

14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J Song whose telephone number is 703-305-4953. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Benjamin L Utech can be reached on 703-308-3868. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9310 for regular communications and 703-872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.

Matthew J Song
Examiner
Art Unit 1765

mjs
July 17, 2002

BENJAMIN L. UTECH
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700